





Preface

Adventures in the Attic

Written by: Alison Hought & Aleya Littleton

Illustrated by: Jessica Bastidas

Hiding science in a storybook...

Think Scientifically books, from NASA's Solar Dynamics Observatory team, integrate a classic storybook format with rich science content, hands-on activities, and interdisciplinary connections

Follow along with Matt and Matilda in "Adventures in the Attic" as they investigate the movement of the Earth in the Solar System and discover what causes the seasons.

To download the free teacher resources that accompany this book, please visit:

<http://sdo.gsfc.nasa.gov/epo/educators/thinkscientifically.php>



Adventures in the Attic

Large drops of rain fell from the sky, creating sheets of water on the ground. The trees slurped up the water quickly as the birds found shelter under their budding branches.

Matt and Matilda looked out the car window. Both noticed the stark contrast between the rainbow beds of blooming flowers and the gray spring sky. Matt and Matilda often have similar thoughts without even knowing it. Things like that happen when you are a twin.





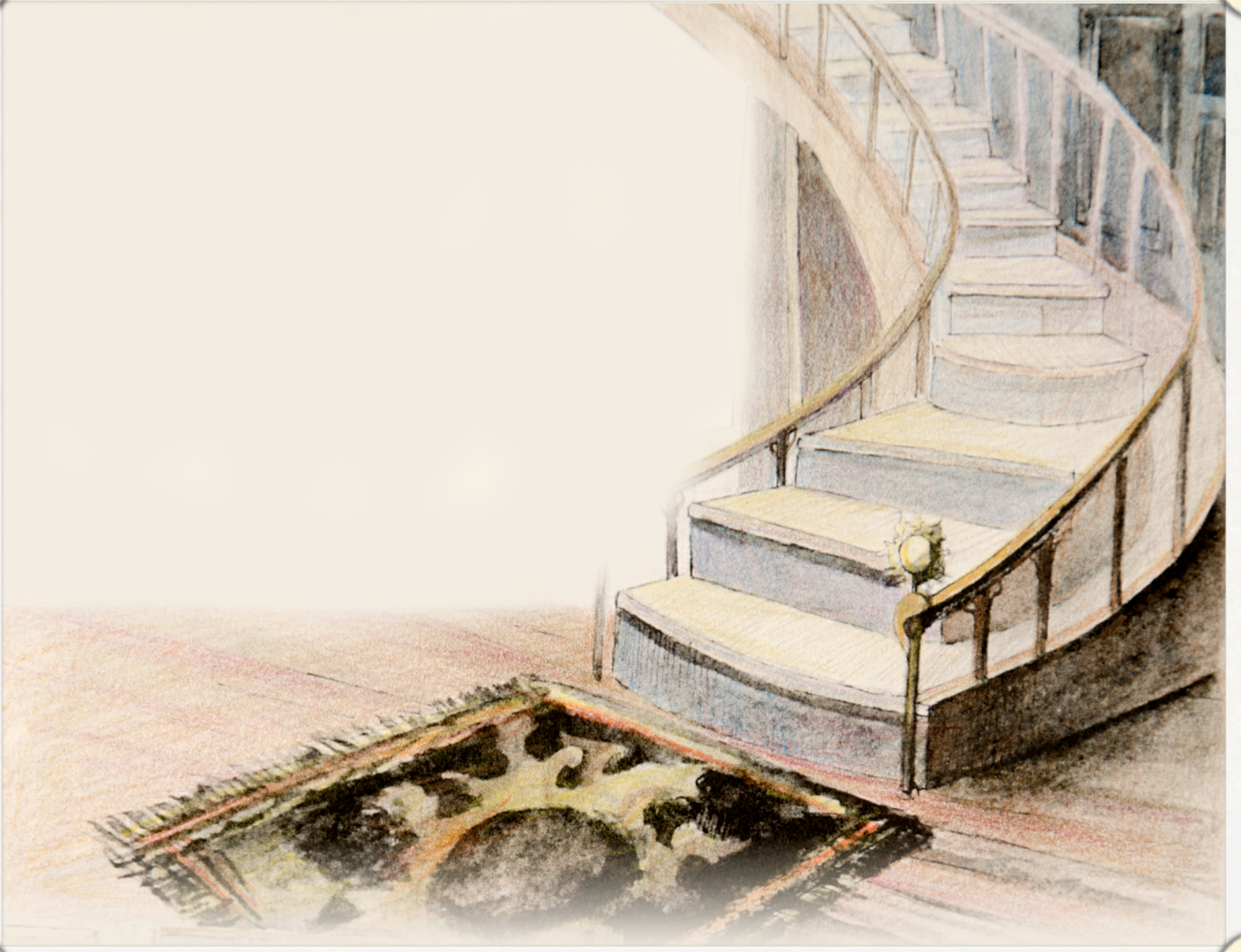
When you are a twin you share the same birthday, the same classes, and the same relatives. Aunt Dramada is the favorite relative of Matt and Matilda. As they approached Aunt Dramada's creaky old house, with its tall windows and large iron fence, they both wished this would be a day of fun. Instead, they anticipated a day of work.

The car rolled to a stop by the front porch. Their dad turned around to the two of them and said, "You have a big science fair project due next week. Your aunt is an astronomer. With her help, I know you can do well on this assignment."



Aunt Dramada swung open the front door before Matilda could ring the chiming doorbell, but Matilda rang it anyway as she walked inside. They all laughed, hugged, said “hello” and waited for the loud, ringing melody to end.





“So, what do you kids need help with?” Aunt Dramada asked.

“We have a science fair project due next week and we are stuck!” Matt said.

“We have to make a 3D model of the relationship between the Earth and the Sun,” Matilda explained.

“The catch is that the model must show the relationship between the Earth and the Sun for an entire year,” Matt added.

“Not to worry kids! I know I can help you with this. I think we can find things to create your model in the attic. Let’s go!” said Aunt Dramada.

Matt and Matilda bolted to the large wooden, winding staircase leading upstairs.

The two walked quickly down the long, dark hallway past old paintings of their ancestors, toward the attic door. Aunt Dramada often told the twins stories about the ancestors in those paintings.

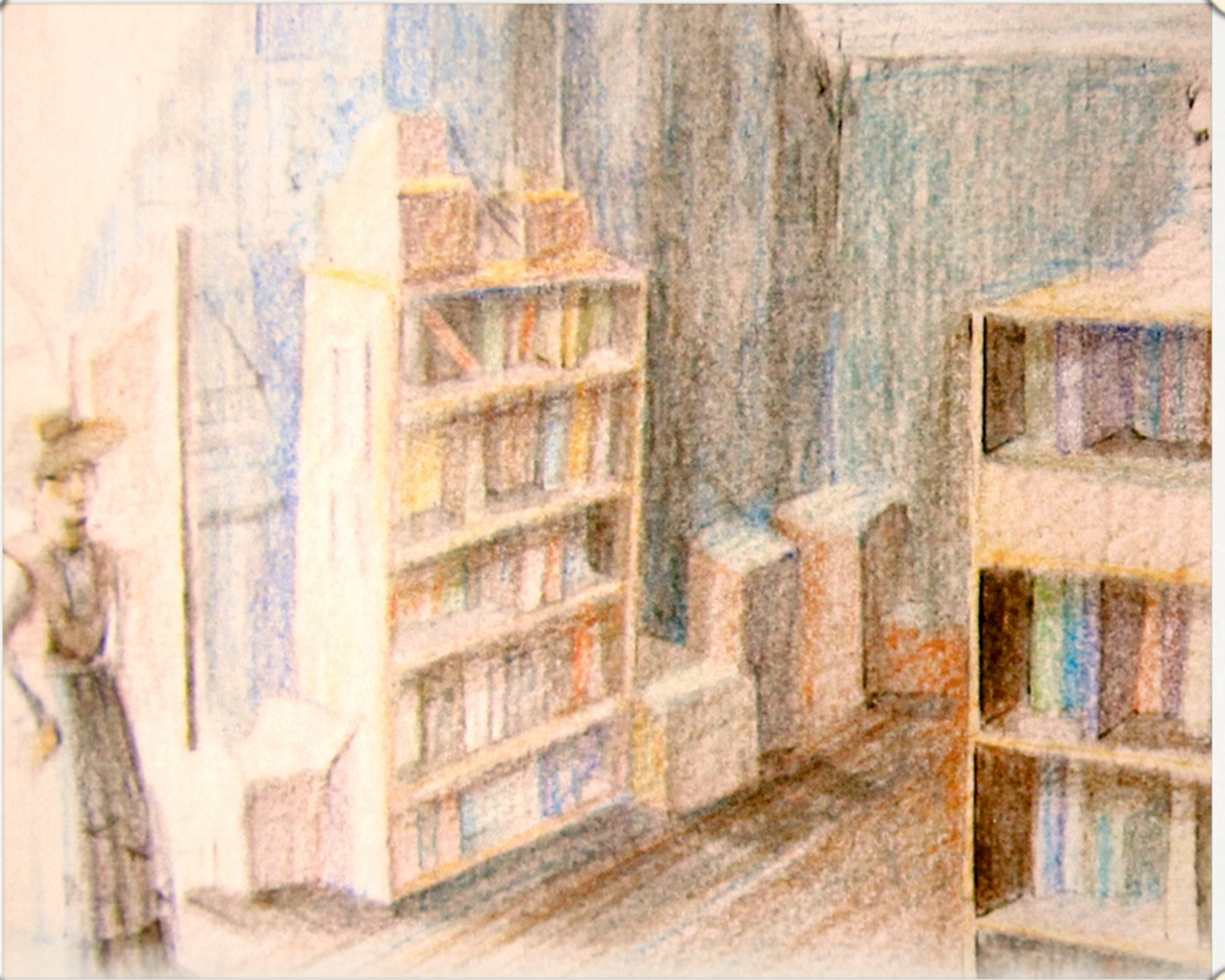
As Aunt Dramada pushed open the squeaky door, a damp musty smell filled the hall around them. With the flick of a light switch, a tall staircase came into view and they all began to climb. The twins were amazed by what they saw at the top!





Despite the musty smell and the dust in the air, the attic was an adventurous place. There were dusty boxes and old trunks lining the walls. Books and trinkets filled the shelves. There was a calendar that hung next to the only window. It said “APRIL” in big letters and reminded Matilda there were only two months left of school.

Aunt Dramada walked over to the window. Opening it she said, “There, this should get some fresh air in here.”



“Look Matilda! There’s a globe over there!” Matt said pointing.

“That would be perfect as the Earth in our model! The Earth takes one day to rotate about its axis; the globe rotates about an axis too!” Matilda exclaimed. “May we use it?”

“Sure you may use it! Just be careful with it. It is an old, special globe that I remember playing with when I was about your age,” explained Aunt Dramada.





“Thanks!” said Matt. “One less thing we have to find!” He brought it over by the window to take a closer look.

“You can search around up here and take whatever you need for your project. I’m going to the store to get something for dinner. I will help you when I get back. Try not to get too distracted while I am gone; your parents are counting on me to help out,” Aunt Dramada said.

“We won’t get distracted!” Matt and Matilda proclaimed.

Aunt Dramada smiled at them knowingly. She turned and walked down the creaky steps.





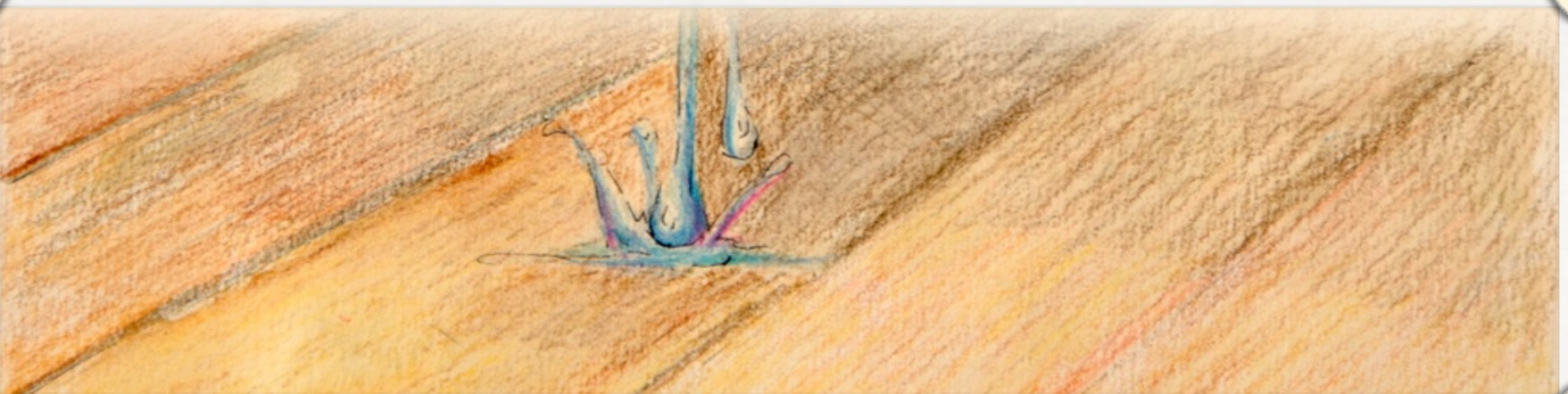
As soon as Aunt Dramada closed the attic door, Matt and Matilda inspected the unique globe they had found. “You can feel all the mountains!” Matilda pointed out.

There were mountains, valleys, and other landforms carved into the globe on each continent. Matt ran his finger over the continents on the globe to feel the landforms. He also ran his finger over the oceans. When he pulled his hand away from the globe he was stunned to feel his finger was wet. “Touch the water!” he timidly whispered to Matilda.



Matilda ran her finger over the oceans then pulled her hand away. She sat shocked and motionless for a minute. Finally she smiled and said, “We are going to have the best science fair project. Aunt Dramada is right, this globe is special!”

“This is so unbelievable!” Matt exclaimed. “Let’s see what else we can find for our project.” Before getting up, the twins poked the blue part of the globe at the same time. They knew they were not imagining things when they saw two small drops of water splash on the dusty floor.



Matt began rummaging through old trunks. He came across a trunk full of old costumes. “Come see this!” Matt called out. Matilda and Matt laughed as they pulled out articles of clothing and held them up to themselves. Matt pulled a wig out of the trunk and a sparkle caught his eye.

“Look at what I found!” he said. “It’s a disco ball. I bet we can use this in our project!”

“I think it would be perfect as the Sun for our model. Good find! Put it by the window with the globe,” said Matilda.





Matilda began looking through drawers of the antique furniture. One bookshelf was stacked with black and white photos. One dresser was filled with old baseball cards. The next dresser Matilda went through was full of Christmas tree ornaments. At the top of one drawer was a glittery plastic star ornament. “I found something to use for Polaris!” Matilda proudly exclaimed.



“You found something to use for what?” Matt asked.

“Polaris, the North Star, silly. It is the star that is always directly above the North Pole, far off in outer space. As the Earth turns on its axis, the stars above us seem to move. Since Polaris is above the North Pole, it does not change position in the sky. Sailors use the North Star to help them navigate because it is a reliable guide,” Matilda explained.

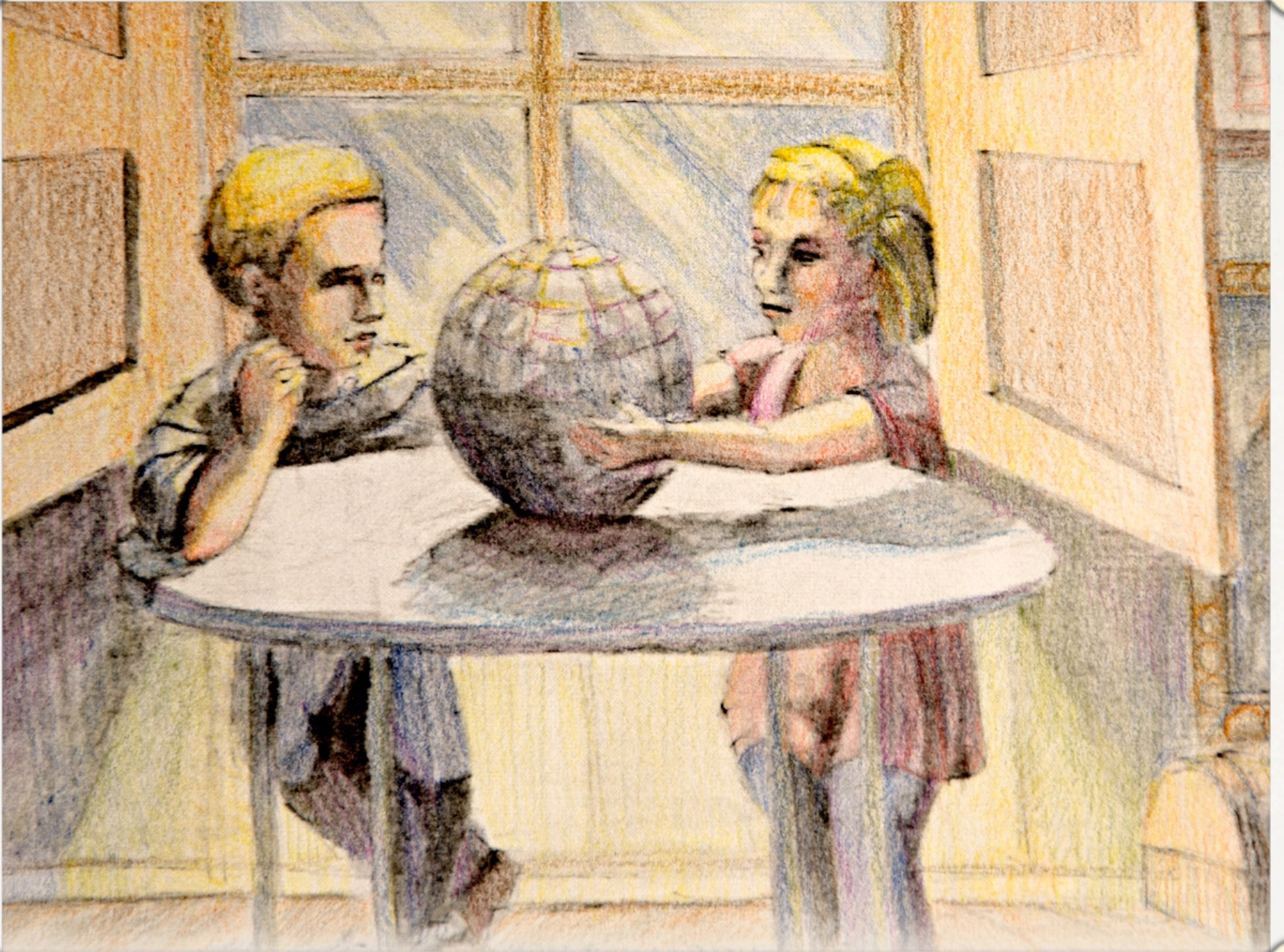
“Oh, I knew that,” Matt mumbled. “Do we need anything else?” he asked.



“Yes, we need something sturdy to put it all on,” she answered. Matilda brought the star ornament over to their other project supplies.

Matt thought for a moment and said, “We need to find something round like the Earth’s orbit around the Sun.” The twins went searching again. Everything round they found was too small. The two flopped on a couch by the window and sighed in frustration. They were so close to creating their model, if only they could find something to put it on!





Suddenly Matt jumped up and darted to a back corner of the attic. He hovered over a round, white table that was just the perfect size to hold the items for their model.

“This will work,” he said as he carried it over to the window. “The Sun is the center of our solar system. We should start by putting the Sun in the middle of the table,” Matt added.

Matilda picked up the disco ball and placed it in the center of the table. “There!” she exclaimed.



Matt picked up the glittery plastic star ornament. “How are we going to attach this to our model?” he wondered out loud.

“That’s a good question. I think we should hang it from this hook for now,” Matilda answered as she pointed out a bent nail sticking out of the wall. “We will figure out a better setup when the model is complete,” she added.

Matt hung the star up and stood back to admire the model they started.

“Now we just need the Earth,” he said. “Should we mark where we live on the globe before we add it to our model?”



Matilda scanned the room and noticed there were two push pins holding up the calendar by the window. “Yes, let’s use this,” she said as she pulled the extra push pin out of the wall. Matt took the pin from Matilda and pushed it into the special globe over the area they live. He then picked up the globe and put it on the round table between the Sun and Polaris.





Suddenly the room started to spin. Matt and Matilda were thrown back on the couch from the force. A cold wind swept through the window and created a dust cloud around them. The pages of the calendar shuffled with the breeze.

The twins sat wide-eyed and frozen staring at each other until the spinning stopped. When the dust cloud cleared, the two saw snow falling outside the window. Large snowflakes glistened in the moonlight. The glow of the moon and the stars replaced the cloudy early evening sky that was blanketing the Earth only minutes before. The calendar, which had just displayed “APRIL”, now displayed “DECEMBER”.





“What happened?” Matt asked his sister in disbelief.

“I don’t know, but it’s a blizzard out there!” Matilda responded.

The twins sat next to the window with their noses pressed against the screen. All the children in Aunt Dramada’s neighborhood were bundled up, running and squealing outside. One boy was even making a snowman. The ground, including the flower bed, was now covered in snow.

“What are we going to do about all this snow?” Matilda asked with concern.

“I don’t know, but we had better fix this mess before Aunt Dramada gets home,” Matt answered.

“Everything changed when you put the globe on the table,” Matilda said. “I know the Earth orbits the Sun once each year, so maybe something will change when we move the globe around the table in our model!”



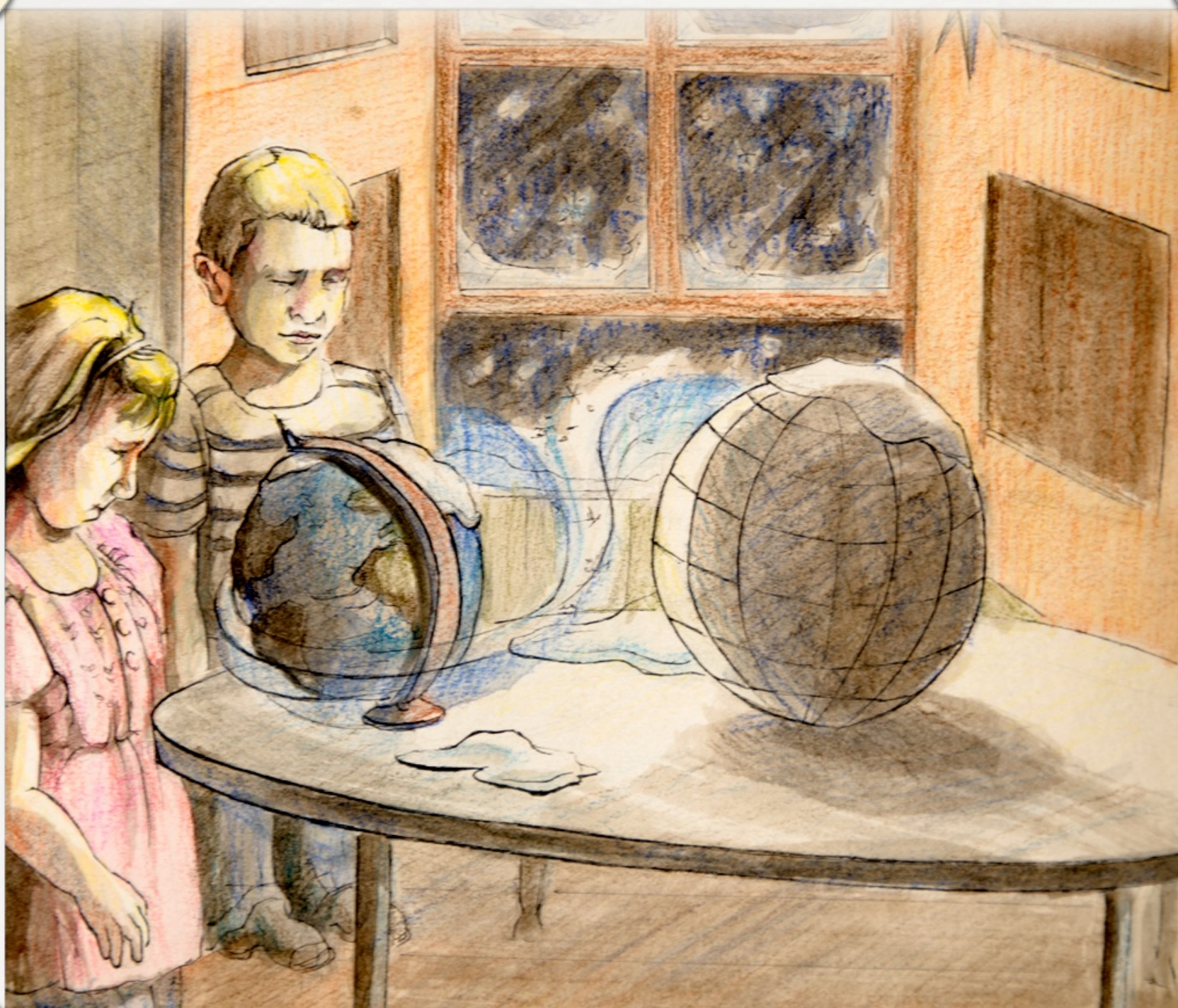
“No!” Matt shouted.

It was too late. Matilda had already picked up the globe and moved it to the other side of the table. The twins grabbed onto each other and closed their eyes. To their disappointment, nothing changed. Cold air still whirled in through the window and snow still poured from the sky.

“I guess nothing will happen,” Matilda said, answering her own question.



“This can’t be right. I know that seasons change as the Earth travels around the Sun. Aunt Dramada told me that they change because the Earth’s axis is tilted, causing sunlight to hit Earth at different angles,” explained Matt. “Sunlight is most intense during months where it hits the Earth straight on, like in the summer; it’s least intense during colder months because it hit the Earth at a shallower angle, which causes sunlight to be more spread out.”





“Does the Earth’s tilt also cause days to be longer in the summer and colder in the winter?” asked Matilda.

“Yes, exactly!” added Matt. “Now let’s figure out how to get back to being warm!”

After they looked at their model for a minute, Matt interrupted the silence. “You said the North Pole always points to Polaris. Do you think we should turn the globe so Polaris is above the North Pole?” asked Matt.

“Go ahead. It is worth a try,” agreed Matilda.

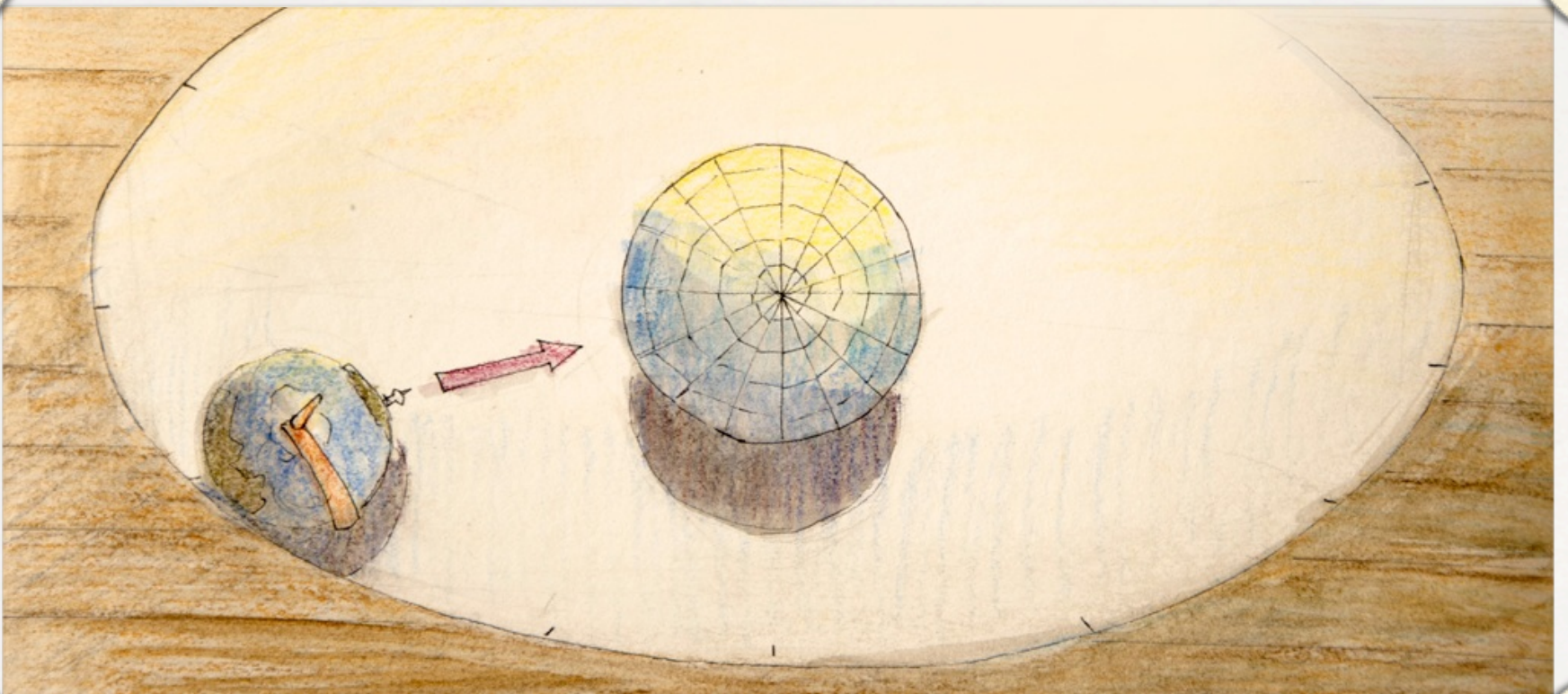
Matt winced with uncertainty as he reached for the globe and turned it to the correct position. Again the room started to spin. Matt fell back onto the couch. Hot air came tearing through the window and, once again, the dust in the attic whirled into a blinding cloud. Matt and Matilda saw the calendar pages blowing in the wind, then closed their eyes until the spinning stopped.

When the wind subsided and the dust cleared, the twins jumped up to look out of the window. The sky no longer held the moon. Instead, the sky was a bright, beautiful blue. The only evidence of the blizzard was the pile of snowman accessories on the neighbor’s lawn. Instead of snow boots and scarves, the children were now wearing swim suits and running through sprinklers. Matt and Matilda both noticed the calendar now displayed “JULY.”



“I can’t figure out what’s going on!” exclaimed Matilda with confusion.

“I think I see a pattern!” proclaimed Matt. “Look at where we live on the globe. The calendar says July and it’s hot outside. This must be how the Earth looks in orbit when it’s July. The push pin is tilted directly toward the Sun, so sunlight is hitting the Earth in our model straight on. That means the sunlight is going to be pretty intense!” he continued.

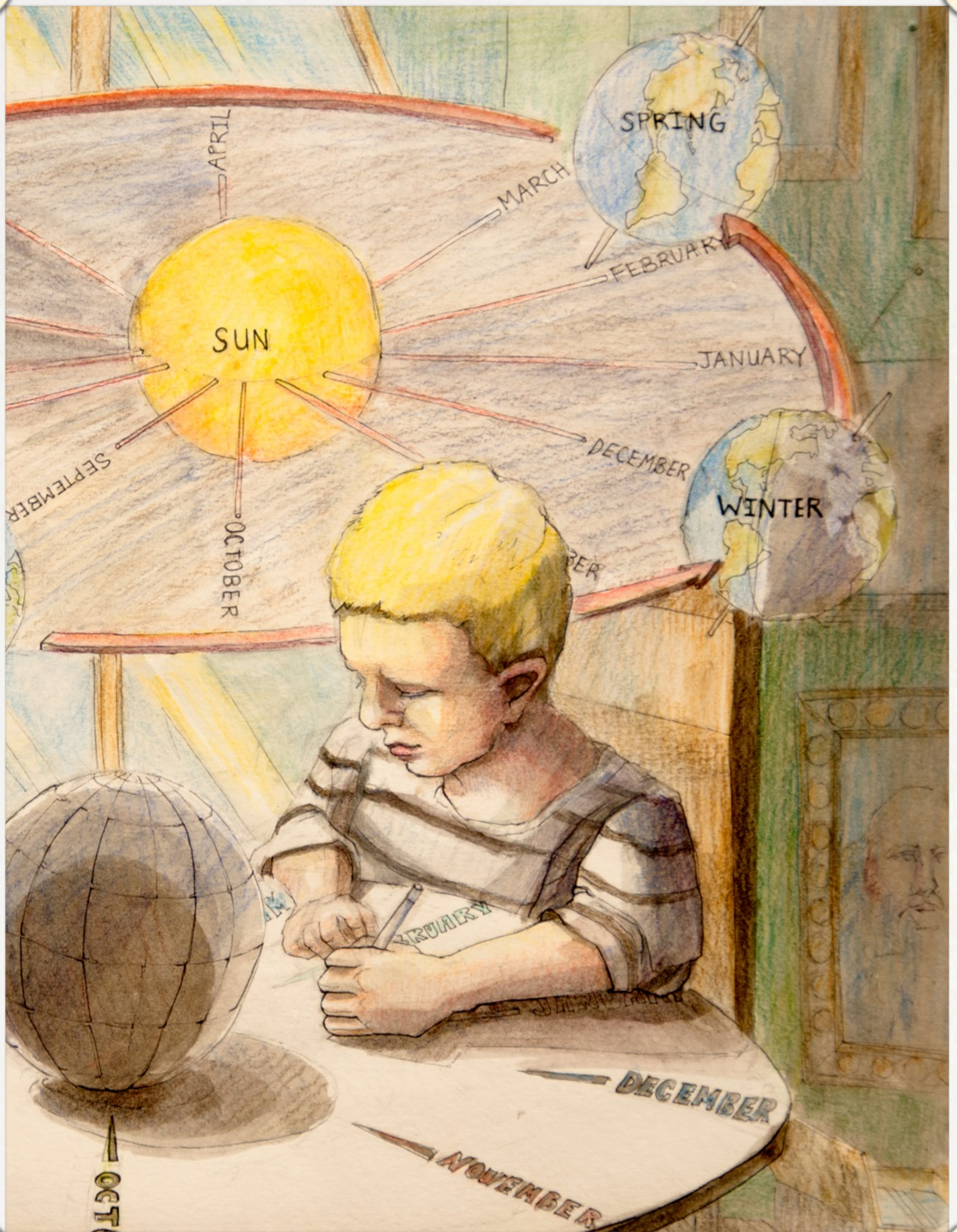


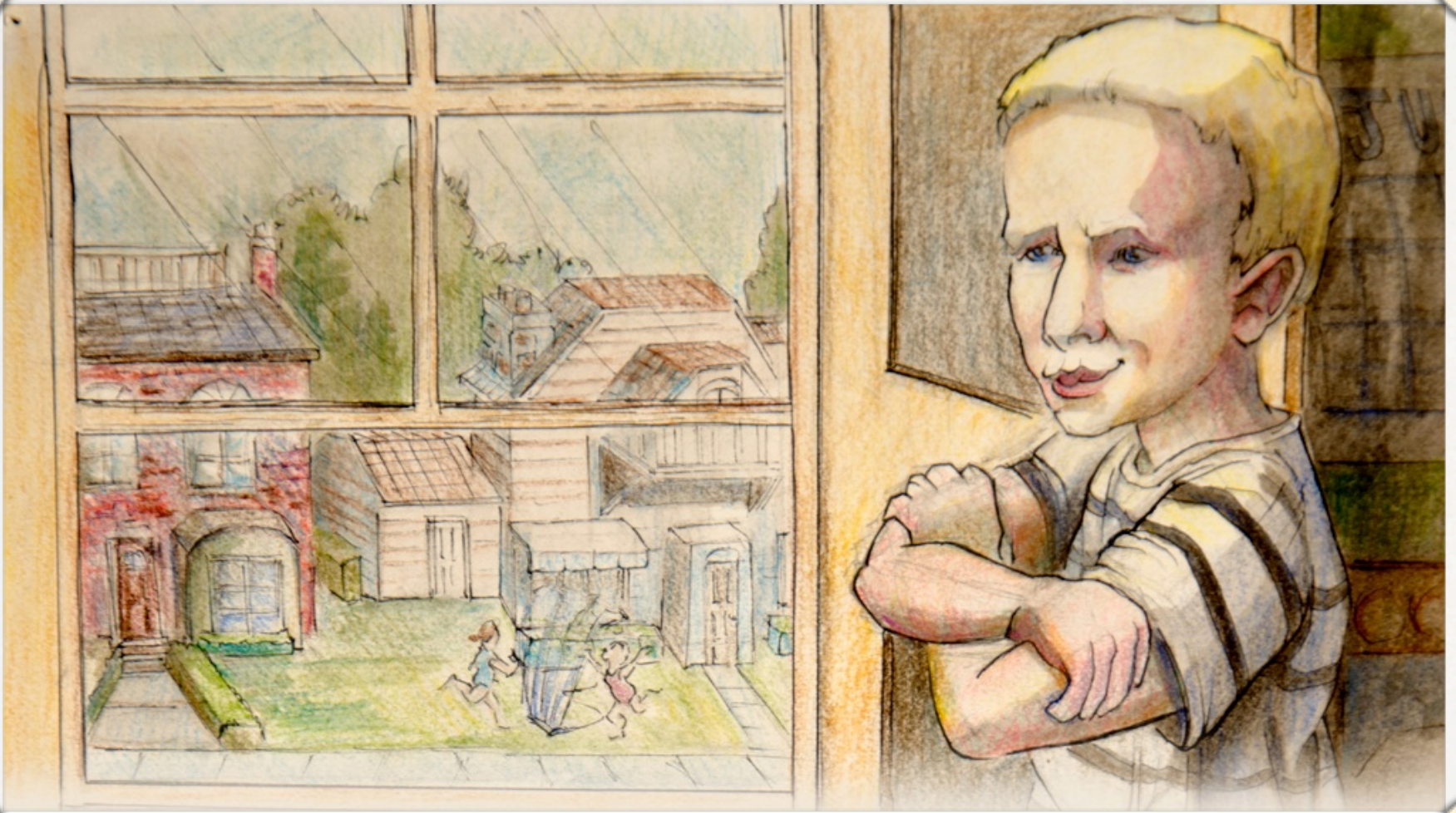
“I think I understand!” Matilda announced proudly. “When the calendar said December, the push pin on the Earth in our model was tilted away from the Sun, so sunlight was hitting it at a shallower angle. This means the sunlight was more spread out and not as intense!” she exclaimed.



Matt and Matilda gave each other a high five and a smile. “Since the Earth takes one year to revolve around the Sun, we should label the months on the table the way the Earth moves through them in its orbit,” Matilda said as she reached into her book bag to get markers. Matt nodded in agreement as he took a marker from Matilda. He then helped his sister write the months around the outside of the table.

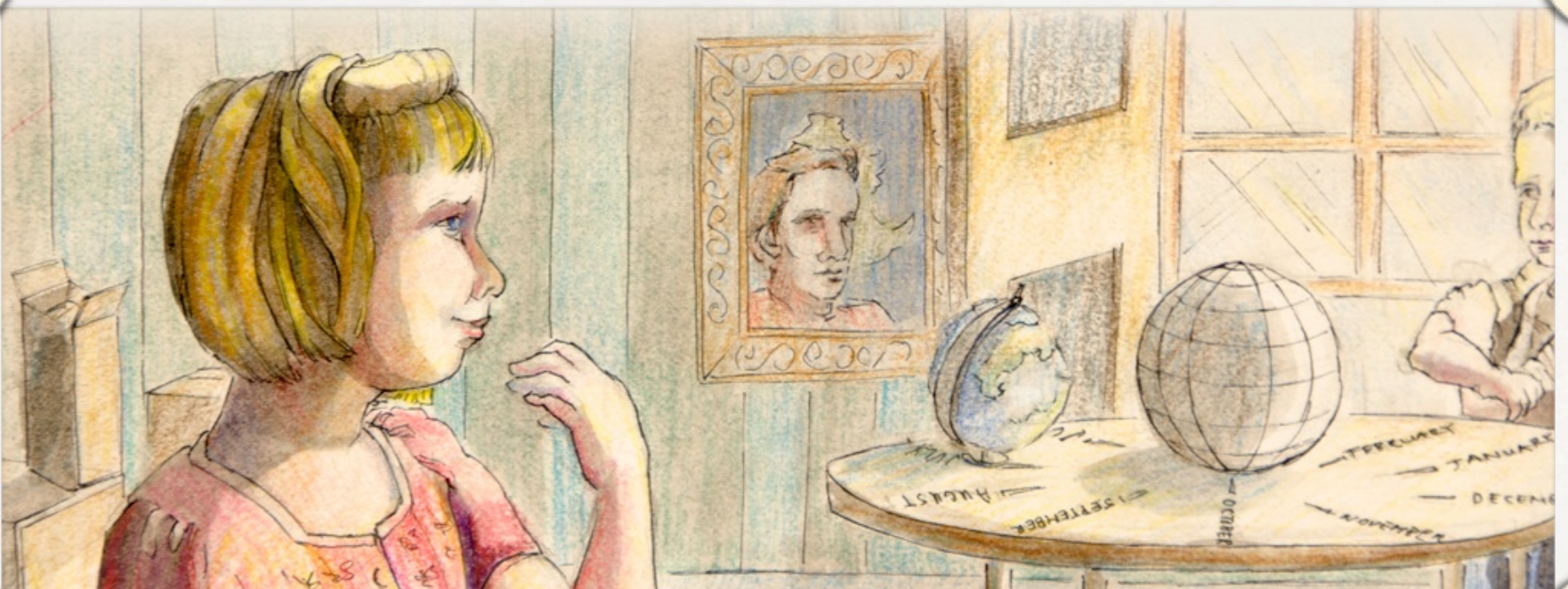






“We should really check our work like our teachers tell us to,” Matt said with a smirk.

“I think you’re right,” said Matilda with a snicker. “I’m getting really hot, so how about we change it to a fall month?” she asked.



The two picked up the globe and moved it to the part of the table labeled October. Before setting the globe down, they made sure the North Pole and Polaris were lined up. Just as before, the room started to spin. Cooler air rushed through the window and leaves of all colors rushed past the window screen. Dust clouded around them again. The twins, not as scared this time, waited until the spinning stopped to run to the window.





“I think we got it right! The calendar shows October!” Matt confirmed.

“I think so, too,” agreed Matilda as they watched the neighborhood children raking piles of leaves to jump in. “The air feels so much cooler now. The Earth’s tilt on its axis is parallel with the Sun in our model. That means we aren’t pointing toward the Sun like in the summer, and we aren’t pointing away from the Sun like in the winter. We are in between and the temperature is also in between,” said Matilda.

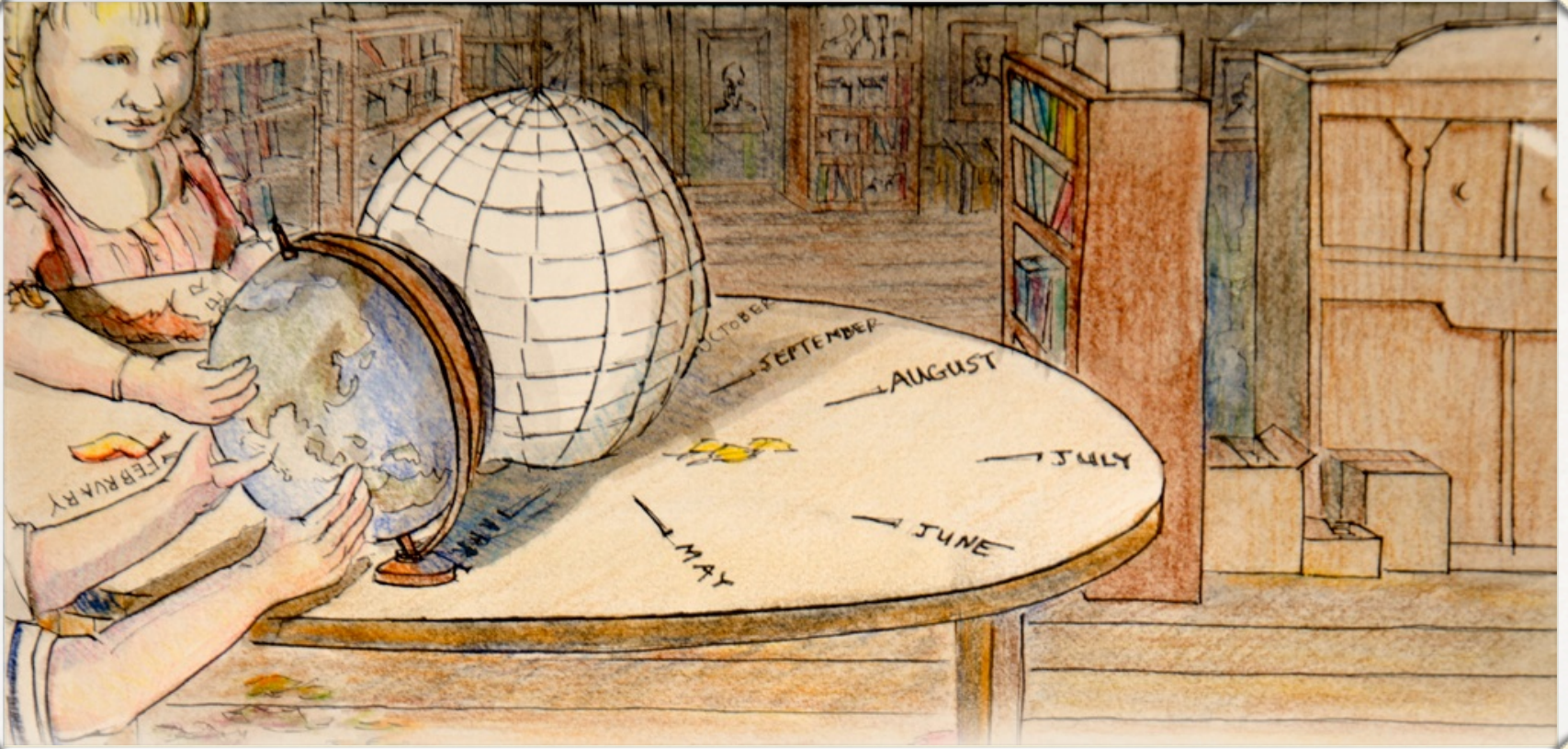




Matt popped up quickly. “We had better fix the weather soon. Aunt Dramada will be back any minute and we don’t want her to see the mess we made!” Matt reminded his sister.

“Okay,” Matilda said. “We should move the globe to where it says ‘April’ on the table. I hope all of the leaves disappear and the buds on the trees and flowers reappear.”





The two picked up the globe, moved it to “April”, lined up the North Pole and Polaris, and set it down. As the globe touched the table, the room began to spin and the calendar pages flapped against the wall. As the spinning stopped, the calendar shuffled to show “APRIL”. Outside the sky was again a misty gray. The snow, leaves, and sprinklers were gone. As the twins heard the front door creak open and shut, they jumped up to their feet. “Aunt Dramada is home!” they said at the same time.



“Do you think she saw anything?”
Matilda asked in a whisper.

“I don’t know, but we are going to
find out!” Matt whispered back.
The door knob to the attic
squeaked as Aunt Dramada turned
it and started up the noisy stairs.
Matt and Matilda stood on either
side of the model and tried to act
normally as their aunt came in to
view.



“Look what you two have done!” exclaimed Aunt Dramada. The twins swallowed hard and waited for what was to come next. She continued, “This project looks fantastic! It seems that you did not need my help after all.”

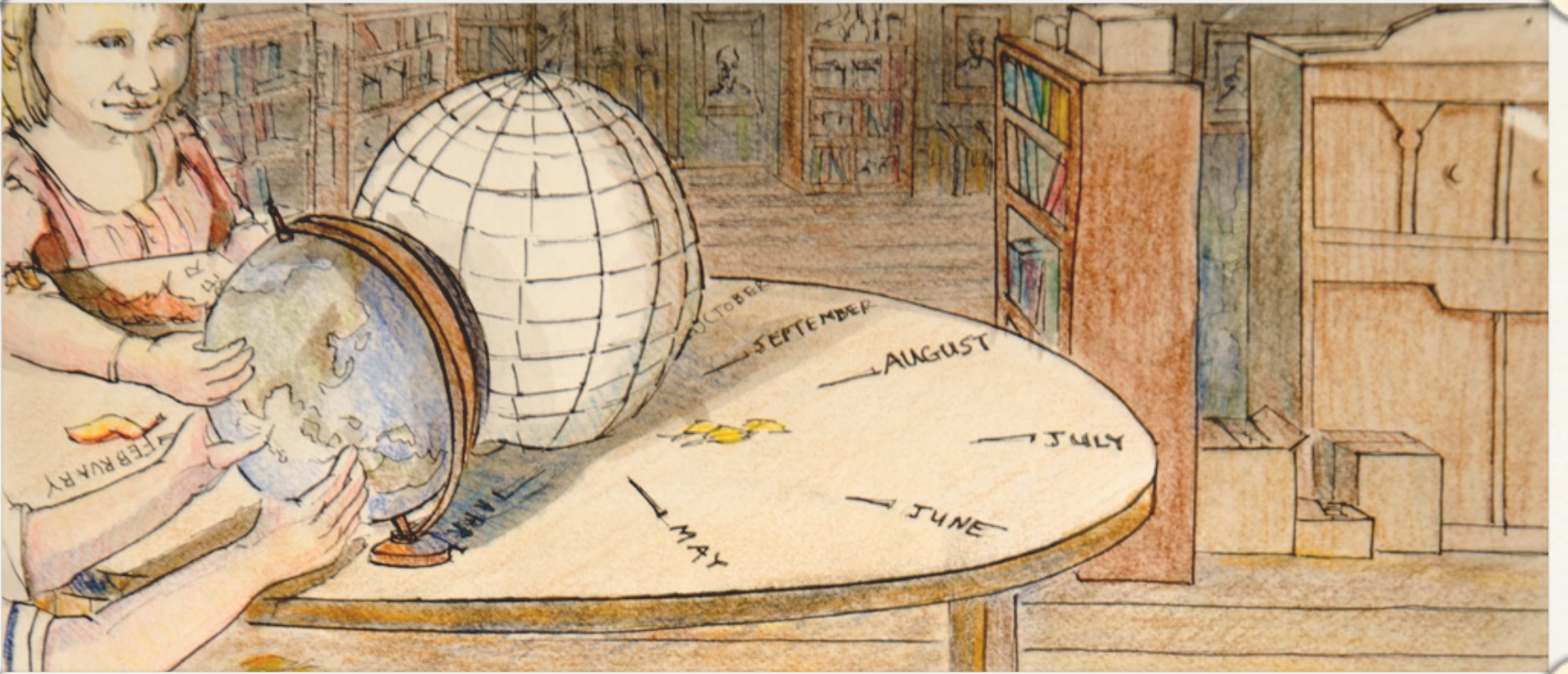
“Thank you!” the twins replied, smiling with relief.

“Dinner will be ready soon. You kids should clean up and come eat,” Aunt Dramada instructed. Before she went down the stairs, she turned to the twins with a mischievous smile and said, “I see you had fun with the globe.”





Before the twins could muster up a response, Aunt Dramada brushed a fall leaf off of her shoulder and walked away.



About the Authors

Aleya Littleton

Aleya Littleton is the Formal Education Coordinator for the Solar Dynamics Observatory. She works NASA's Goddard Space Flight Center in Maryland making things for students and teachers, visiting classrooms, blowing things up, and getting messy – for science! She is a former middle school teacher, having taught in Pennsylvania and Florida. When she has spare time, you can find her climbing rocks, planning adventures, and plotting world domination.

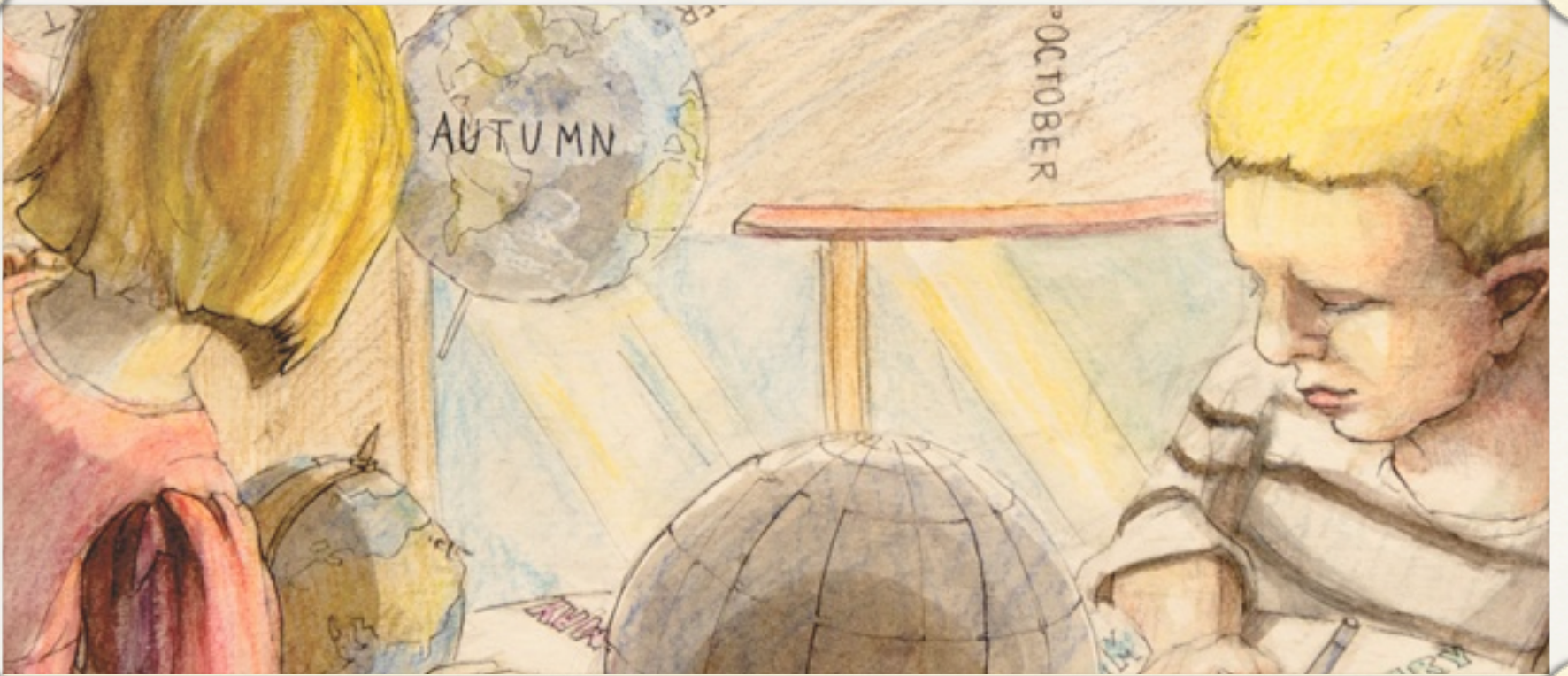




Ali Houghton

Ali Houghton proclaimed as a little girl that she would one day grow up to be a teacher and a writer. She currently teaches sixth grade at South Mountain Middle School in Allentown, Pennsylvania, where she also resides. Ali lives with her husband, Tim, several pet turtles, and a cat named Sweetie Pie (who she taught to give kisses). When Ali is not teaching or writing, you can find her doing a variety of crafts or fishing with her husband.

“I dedicate this book to my father, Robert H. Hegney (1953 - 2007), who once told me the Earth was running out of gravity so I would stop jumping and tumbling and shaking the house.”



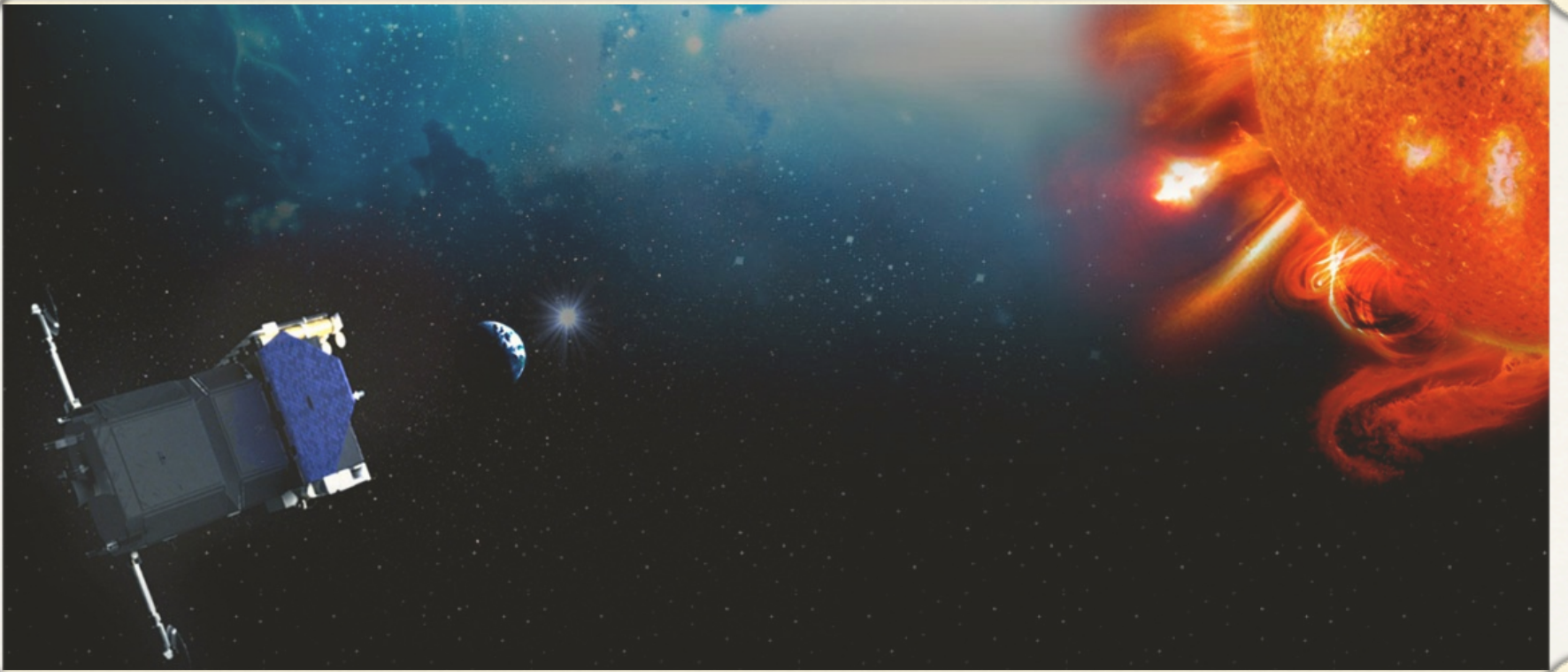
About the Illustrator



Jessica Bastidas

Jessica Bastidas is an aspiring children's book illustrator; *Adventure in the Attic* is her first published collection of illustrations. She is currently a Senior Visual Art major at the Lehigh Charter High School for the Performing Arts. When not drawing or involved with another project, which is rare, Jessica divides her time between mixed martial arts, her friends, and family.

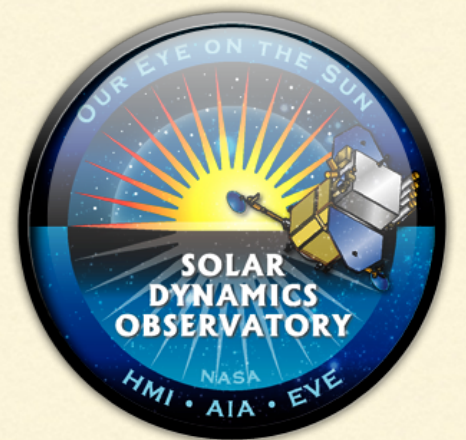
For my models Tanner and Lisa, and with special thanks to my family and art teachers.



About the Mission

The Solar Dynamics Observatory

SDO is the most advanced spacecraft ever designed to study the Sun and its dynamic behavior. It is providing better quality, more comprehensive data faster than any NASA spacecraft currently studying the Sun and its processes. SDO will unlock the secrets of how our nearest star sustains life on Earth, and affects the planets of our solar system and beyond.



To learn more about SDO visit <http://sdo.gsfc.nasa.gov>

To download the free teacher resources that accompany this book, please visit:

<http://sdo.gsfc.nasa.gov/epo/educators/thinkscientifically.php>

Glossary

Astronomer - Someone who studies the planets, stars and other objects in space.

Axis - An imaginary line through the middle of a rotating object around which the object spins.

Continent - One of the seven great divisions of land on Earth (North America, South America, Europe, Asia, Africa, Australia and Antarctica).

Model - A copy of something, often smaller than the original object.

North Pole - The northernmost point of the Earth.

Orbit - The path followed by an object in space as it goes around another object.

Polaris (or North Star) - If you are standing at the North Pole, this is the star that will be almost directly overhead. It remains in the same location in our sky all year long.

Rotate - To turn around a center point, or axis, like a wheel turns on a bicycle.

Season - Each of the four divisions of the year (spring, summer, autumn, winter) marked by particular weather patterns and daylight hours, resulting from the Earth's changing position with regard to the Sun.

Solar System - A star with a group of planets and other objects revolving around it. The Sun (a star) is at the center of our Solar System; it has eight planets revolving around it as well as moons, comets, and other space-related objects.

Astronomer

Someone who studies the planets, stars, and other objects in space.

Related Glossary Terms

Drag related terms here

Index

Find Term

Axis

An imaginary line through the middle of a rotating object around which object spins

Related Glossary Terms

Drag related terms here

Continent

One of the seven great divisions of land on Earth (North America, South America, Europe, Asia, Africa, Australia, and Antarctica).

Related Glossary Terms

Drag related terms here

Model

A copy of something, often smaller than the original object.

Related Glossary Terms

Drag related terms here

North Pole

The northernmost point of the Earth.

Related Glossary Terms

Drag related terms here

Orbit

The path followed by an object in space as it goes around another obj

Related Glossary Terms

Drag related terms here

Polaris (or North Star)

if you are standing at the North Pole, this is the star that will be almost overhead. It remains in the same location in our sky all year long.

Related Glossary Terms

Drag related terms here

Rotate

To turn around a center point, or axis, like a wheel turns on a bicycle.

Related Glossary Terms

Drag related terms here

Season

Each of the four division of the year (spring, summer, autumn, winter) particular weather patterns and daylight hours, resulting from the Earth's changing position with regard to the Sun.

Related Glossary Terms

Drag related terms here

Solar System

A star with a group of planets and other objects revolving around it. The star) is at the center of our Solar System. It has eight planets revolving as well as moons, comets, and other space-related objects.

Related Glossary Terms

Drag related terms here